Ministry of Lands, Parks and Housing Approach to Calculating Opportunity Costs of Forest Industrial Values in Ecological Reserves

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Preface

The Executive Committee of the Ministry of Lands, Parks and Housing has endorsed the opportunity cost approach outlined in this paper as the appropriate method to determine the economic costs associated with foregone timber production in ecological reserves. These opportunity cost measures are one of the elements of the Ministry's Cabinet submissions on proposed ecological reserves. They serve to provide Cabinet with an estimate of the impacts on the British Columbia economy of preserving rather than consuming resources on the proposed reserves.

It is intended that by stating our opportunity cost approach we may help clarify the economic aspect of ecological reserve proposals, which in the recent past has been the subject of much debate.

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1. Introduction

Cabinet ministers need to know the economic implications of government actions, including the establishment of ecological reserves. This brief paper, which is intended for the authors of Ecological Reserve Cabinet Submissions, outlines some guidelines on appropriate techniques for a simple, quick evaluation of the economic opportunity costs associated with foregone timber production, which is in most cases the indicated alternative land use of timbered land proposed for ecological reserve designation. The guidelines have been based on the Ministry of Lands, Parks and Housing's experience with evaluations of the Windy Bay/Dodge Point, Khutzeymateen, and Tsitika Ecological Reserve Proposals.

2. Analytical Framework for Economic Evaluation of Ecological Reserves

A government decision on the establishment of an ecological reserve includes an economic decision on resource investment project alternatives.[1] In simplified terms, the choice is one of whether to invest provincial land and other resources in:

a. preservation of the area, as defined in the Ecological Reserves Act (1971); or

b. one or more of the competing uses of the area, usually involving the production of goods and services such as timber, minerals, recreation, transportation services, agricultural products, etc.

The technique specifically designed and most often used to analyse the economic implications of public sector investment decisions is social benefit-cost analysis (SBCA). By using SBCA, one can estimate the change in net income (economic growth) in the provincial economy as a result of pursuing one

investment project rather than another. It thus provides a method by which to rank alternative investment projects according to their contributions to the provincial government's economic objectives.[2]

The fundamental concept of SBCA is social opportunity cost, or, what society must give up to gain something else of value.[3] Where the commitment of land to a particular use is involved, the opportunity cost is the value of the goods and services flowing from its next best alternative use. For example, in the case of establishing an ecological reserve on provincial forest land, the net flow of goods and services from the land in forest use is an opportunity cost of the ecological reserve.

Ideally, through the use of social benefit-cost analysis, it would be possible to compare the present value of net benefits of the ecological reserve proposal with the present value of net benefits of the land's competing uses.[4] Unfortunately, such a comparison is not possible, since most of the value to society of ecological reserves cannot be measured in terms of quantifiable dollar values. It is therefore necessary to rely on a descriptive analysis of the reserve's intangible values and on the ability of the decision-maker to compare this descriptive evaluation with both the quantifiable and non-quantifiable values of competing uses of the area. Ecological reserve values include the "option" and "existence" values of retaining unique and/or representative natural phenomena, maintaining gene pools, and undertaking biological research.[5] The Tsitika Cabinet Submission, which provides a model for descriptive evaluation of ecological reserves, addresses the following key aspects:

a. Historical background of the reserve proposal;
b. Primary and secondary purposes of the reserve;
c. Rare and/or representative features;
d. Rationale or justification for establishing the reserve;
e. Replication or other relationships to existing reserves;
f. Location map and map of reserve boundaries.

It is suggested that all Cabinet Submissions on ecological reserve proposals, in addition to containing a descriptive analysis of ecological reserve values, also include an analysis of the opportunity costs of the reserve calculated using the SBCA principles set out in the provincial government's Guidelines for Benefit-Cost Analysis. In the following section, specific suggestions are offered in addition to the Guidelines for calculating the opportunity costs associated with the most common competing land use, industrial forestry.

3. Guidelines for Evaluating Foregone Timber Production

3.1 Stumpage as the Baseline Value for Estimating Net Benefits

The Guidelines describe measurement principles for calculating gross benefits and costs which are subtracted to equal net benefits. In the case of timber production from a particular land parcel, these calculations require data on both the estimated prices of the logs traded in competitive markets, and the costs to British Columbians of producing the timber, including logging costs, road construction costs, an allowance for producers' profit, silviculture and forest management costs, etc. If, as is often the case, these price and cost data are not available, the Ministry of Forests' stumpage appraisal system provides a reasonable

approximation of the net benefits of timber production. The Ministry of Forest's method of calculating stumpage, outlined in Section 84 of the Forest Act, consists of subtracting the costs of timber production, including an allowance for profits, carrying charges, interest and risk, from estimated forest product sales values. The stumpage formula likely results in an under-estimate of timber values since it allows for a private rate of return based on product values rather than a real rate of return on capital. However, stumpage provides a good "ball park" figure for the net value of timber and thus is suitable for evaluating the opportunity cost of ecological reserves.

3.2 Average Stumpage over Ten Year Period

British Columbia log and lumber markets experience pronounced cycles wherein prices rise and then fall over a period of several years. Likewise, stumpage values are observed to peak and trough since they are based on log or lumber prices. Thus, using stumpage values during a single year as representative of net timber values can result in estimates of timber opportunity costs that are many times higher or lower than the long-run average. For example, as noted in Attachment 1 to the Khutzeymateen Cabinet Submission, the disparate estimates of timber values in the Khutzeymateen Valley are at least partly the result of the use of different valuation years for the market price of spruce logs. The range of stumpage values over the price cycle is demonstrated by the following table showing the historical pattern of stumpage per cubic meter in the Prince Rupert Forest Region.

Prince Rupert Forest Region
Stumpage per m^3 of Spruce, 1972 - 1981

1972	$ 2.30
1973	6.11
1974	6.61
1975	3.80
1976	3.27
1977	3.45
1978	5.73
1979	15.11
1980	34.03
1981	$11.33

Source: British Columbia Ministry of Forests (1972 through 1981) Annual Report, "Average Stumpage Prices Received on Timber Billed from Tree Farm Licences, Timber Sale Harvesting Licences and Timber Sale Licences other than Small Business Sales, by Species and Forest Region".

Given the above table, it is not surprising that for spruce in the Khutzeymateen, the use of 1976 stumpage information gives total stumpage revenue of $3.9 million while the use of a 1979-1981 average stumpage value results in total stumpage revenue of $25.7 million.

Long-run net timber values may be estimated most consistently by using the long term mean average timber stumpage.[6] As a rule of thumb, a ten year average should be used.

3.3 Net Present Values

Foregone timber values should be presented in net present value terms using the discount rates recommended in the Guidelines and based on the estimated annual reduction in timber availability for the area of forest land in question.[8] The assumption of equal reductions

in timber availability is recommended rather than the assumption of a particular harvest schedule, in order to prevent the situation where the magnitude of the discounted timber values may be manipulated by assuming shorter or longer harvest schedules. Concerns that the annual allowable cut estimates for certain areas may not be realistic must be ignored here for the sake of simplicity.

In addition to net present values, annual estimates of foregone values and volumes may also be presented since they reflect the nature of a decision regarding an ecological reserve proposal which may be thought of as having annual impacts in perpetuity.

3.4 Provincial Taxation Revenue and Employment Impacts

The estimated annual impacts on provincial tax revenues and employment attributable to the withdrawal of timber from the provincial harvest should be included in Cabinet Submissions on ecological reserve proposals. These tax revenue and employment impact estimates are usually calculated using an average multiplier method, which has been termed the "unit volume impact" method. As explained in this subsection, problems may arise when these rough estimates are interpreted either as hard numbers, or as the total provincial impact rather than, more specifically, the impact on the forest sector, or when the estimates are inappropriately included as part of the net benefit of timber production calculation.

The unit volume impact on provincial tax revenues (or employment) is calculated as follows.[9] Provincial income tax revenues (or employment) from the forest industry and its employees is divided by the timber harvest volume, to give the average tax revenue

(employment) per unit of timber harvested. This average per unit figure is then multiplied by the foregone timber availability to provide an estimate of the impact of the ecological reserve designation on provincial tax revenues (employment) from the forest sector.
The accuracy of these impact estimates is questionable since the calculation relies on the assumption that the relatively complex relationship between timber harvest volume and tax revenues (or employment) can be reduced to a simple, constant factor of multiplication and still provide realistic impact measures for a site-specific case. More accurate impact estimates can be derived using rigorous economic analysis methods but such analysis involves considerable time and expense. In lieu of these more costly impact estimates, the rough unit volume impact estimates are suggested to be acceptable for inclusion in ecological reserve Cabinet Submissions. However, both the impact estimates and rough net benefit calculations should be accompanied by a qualifying statement to explain their exact meaning and limitations.

In particular, unit value impacts (calculated as shown above), do not represent the impact of reduced timber availability on the entire provincial economy, but rather the impact on the forest industrial sector alone. The provincial economy will be unaffected by the decreased timber availability to the extent that the forest industry and employees find investment opportunities and employment elsewhere in the province and continue to earn a fair market return for their capital and labour.

The tax revenue and employment impacts of ecological reserves on the economy as a whole (the social

opportunity costs), arise where capital and labour which would otherwise be used in timber production are unemployed or under-employed elsewhere in the province as a result of establishing an ecological reserve. With regard to provincial tax revenues, unless the forest industry capital that would otherwise be invested in timber production is removed from the province, income taxes should not enter the social benefit-cost calculation.[10] If this actual impact on tax revenues is not known, then the unit volume tax revenue impact estimates should be presented in the financial implications section of the Cabinet Submission, not as an element of net benefits from timber production.

Similarly, reduced employment in the forest industry will affect provincial employment income to the extent that workers are unable to find other work in the province. The Guidelines, pages 49 to 51, outline a fairly complex method of calculating this income reduction during times of labour unemployment or under-employment. Essentially, the method adjusts the market price of labour (wage costs) in a particular sector to reflect that the opportunity cost of unemployed labour is zero and that of under-employed labour is less than the wage cost. During periods of high unemployment or in the event that time and funding prohibit complex economic calculations, the unit volume employment impact estimates may be included in the Cabinet Submission. However, they should appear as a separate statement of approximate employment impacts, not as an element in the net benefit calculation.

4. Summary of Opportunity Cost Guidelines

a. Generally, follow the principles set out in the provincial government's Guidelines for Benefit-Cost Analysis.

b. Use the Ministry of Forests' stumpage data for the baseline measure of net benefits from timber production.

c. In view of forest product cycles, use ten-year averages of stumpage values.

d. Express forest values in net present value terms using the discount rates recommended in the Guidelines and based on the estimated annual reduction in timber availability.

e. Unit volume tax revenue impact estimates should be included under the financial implications section of the Cabinet Submission, with a concise explanation of their meaning and method of calculation. Similarly, unit volume employment impact estimates should not be included as net benefits, but should be presented in a separate statement on estimated employment impacts, again with an explanation of the meaning and derivation of the estimates.

This paper is focused on the timber production aspect of forest management which in recent years has been the most common alternative land use of ecological reserve proposal areas and the focus of most ecological reserve Cabinet submissions. However, ecological reserves are proposed for areas involving other land uses or combinations of land uses,

e.g. agriculture or recreation and wildlife range or B.C. Hydro flood reserve. The Guidelines present some principles for evaluating the social opportunity costs of these other land uses. As well, provincial resource agencies have undertaken applied economic analysis of resource values and concomitant land values. More work on opportunity cost guidelines will need to be undertaken to address these values and as techniques are improved for calculating forest industrial values.

5. Notes

[1]See Scott (1973, 30).

[2]From the November 1978 Conference of First Ministers, the provincial government's stated broad economic objectives are:

1. Maintenance and enhancement of the real incomes of British Columbians through increased productivity and containment of inflation;
2. Continued growth in opportunities for productive employment available to the people of British Columbia;
3. Regional balance ensuring that all regions of the province realize their economic potential and share accordingly in the economic growth and development of the province;
4. Provision of long term stability of employment and real incomes in the province;
5. Continued emphasis on protecting the environment for present and future generations.

From the July 7, 1983 budget speech, another objective may be added:

6. Achievement of a balance between the restraint which is essential to longer term recovery and the provision of funding to stimulate employment in the short term.

[3]British Columbia Environment and Land Use Committee Secretariat, (1977, iv). It is suggested that the reader see the Foreword and Chapter 1 of the provincial government's Guidelines for Benefit-Cost Analysis.

[4]The present value of a stream of yearly net benefits to infinity is obtained by discounting the future net benefits back to a common base in time using the social rate of discount. The use of a present worth value gives recognition both of the fact that a dollar today is worth less than the same dollar tomorrow because of interest costs which occur over time, and to reflect the relative importance of the present generation's income as compared to future generations' income.

[5]Option value is the value that an individual places on retaining the option to a good or service for which his future demand is uncertain. Existence value is the value which individuals place on knowing something exists regardless of the fact that they feel certain they will never have or choose an opportunity to obtain the services it provides. Progress is currently being made by theoretical economists in the quantification of option and existence values.

[6]Calculation of an average price over several years requires that the price series be deflated by an appropriate forest industry product price index, available from Statistics Canada, catalogue number 62-008.

[7]British Columbia Ministry of Forests (1981, 12-13).

[8]The annual reduction in timber availability may be roughly approximated by the mature stock volume divided by the rotation period. This gives a conservative estimate because it does not take into account the annual average growth of immature timber.

[9]These unit volume impacts are calculated as follows:

1. $t_i = (T_i/V_i) \times f$, $i = 1,2,3$
2. $e_i = (E_i/V_i) \times f$, $i = 1,2,3$

where:
t = unit volume tax impact;
e = unit volume employment impact;
T = provincial taxes attributable to the forest industry and its employees (i.e.: corporate taxes plus personal taxes of employees);
E = number of jobs in the woods, sawmills or pulpmills.
V = annual timber harvest volume;
i = subscript which refers to the coastal forest industry when i = 1, interior forest industry when i = 2, or the total provincial forest industry when i = 3.
f = volume of foregone timber harvest associated with the ecological reserve proposal.

[10]British Columbia Environment and Land Use Committee Secretariat (1977, 124).

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